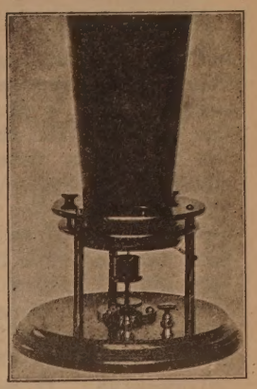
Vol. V No. 4 April 1976 Monthly except during July and August Price $4.50 yearly Single Issue 75¢ Publisher, Jim Cranshaw

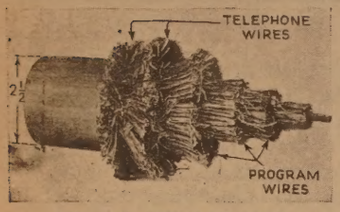
Second-class postage paid at Dallas, Texas Office Address: 9820 Silver Meadow Drive, Dallas, Texas 75217 214-286-1673

THE NEWSPAPER FOR THE HOBBYIST OF VINTAGE ELECTRONICS AND SOUND

THE HORN SPEAKER

TELEPHONE CENTENNIAL
1876 - 1976



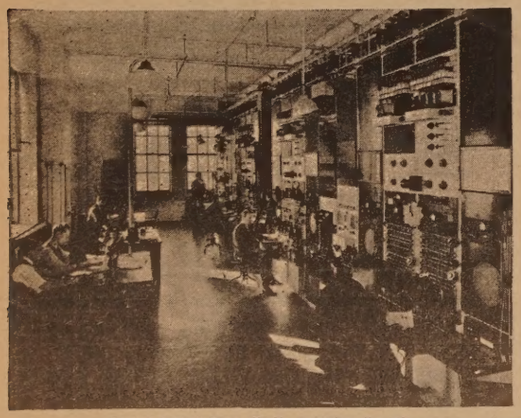


Cables are the "web" of radio networks.
(Bell Tel. Co.)

THE OPERATION OF BROADCAST NETWORKS

Telephone lines and associated equipment are a most important item in broadcast operation. "Radio" programs often travel 10 times farther by wire than by "air"!

R. D. WASHBURNE



General Control Room, N. Y., supervises the nets.
(Bell Tel. Co.)

Modern studios are veritable super-theatres.
(NBC)

Remote pick-ups announced the arrival of "the fleet."
(CBS)

DOES it ever occur to you that the radio program which you hear may not originate from your favorite local radio station—perhaps 25 or 50 miles away—nor is it a radio broadcast from a station in which the program originates, perhaps 3,000 miles away?

New Yorkers, listening to the President at his desk in Washington, D.C., deliver one of his nation-wide broadcasts, little realize that the voice they hear from, perhaps, their local New York station, WABC, has to travel about 300 miles along special telephone or "program" wires, as they are called, before "going on the air." At the same instant, the program is going out over the network of special program wires that extend 3,000 miles to stations on the West Coast, and via arteries of copper that branch to intermediate broadcast stations in the network system.

If Mr. Jones, listening at his radio set in Los Angeles, let us say, tuned to station KNX in the same city, hears this program with full esthetic value, is the efficiency of transmission to be credited to the broadcast station, which has transmitted the program only a few miles to Mr. Jones' home, or to the telephone or program circuits which, sheathed in lead cables of 200 wires, have carried the program 3,000 miles over mountain and valley, and under river and lake, without losing a single syllable? A review of some of the factors involved in radio network operation may serve to show the importance of this web of highly developed telephone lines which join together in one great family every radio station in the land.

The Purpose of "Networks"

Three major functions are performed by the tentacles of copper that reach to nearly every square foot of the United States.

First, they serve to bring the program from the point of pick-up to a "General Control Office." Second, they carry the program from the General Control Office to all the broadcast stations within a wide area. And, third, they carry monitor messages, conversations, directions and orders over express circuits from pick-up to General Control Office, and to the broadcast stations.

The production of the studio program is another story, and one which has been interestingly told to the readers of RADIO-CRAFT, in the article, "From Microphone to Modulator" (January, 1930, issue).

The first "network" dates back to January, 1923, when WEAF, New York, was tied to WNAC, Boston. The climb to the 11 basic networks that comprise our present broadcast system was an arduous one. Now, the web of this amazing institution consists of 74,000 miles of wire, requiring a maintenance personnel of almost 500 specially trained employees, in order to secure faithful sound transmission and reliable operation at all times. A network of about 50 stations now costs a sponsor approximately $12,000 per hour!

Fidelity the Foremost Factor

It is little realized that there is one quality above all others which must be kept inviolate by every single device in the entire radio system. We refer to FIDELITY; unless the

(Continued on page 3)

COPPER-OXIDE PICKUP

A NEW phonograph pickup that requires only 1 stage of audio amplification and gives lifelike reproduction. Former phonograph pickups required at least 2 stages of amplification. Since many sets have only 1 stage of A.F., it usually requires the addition

* Acoustic Engineer, Amperite Corp.

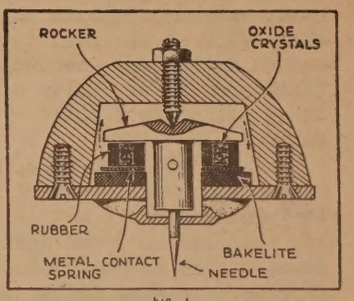
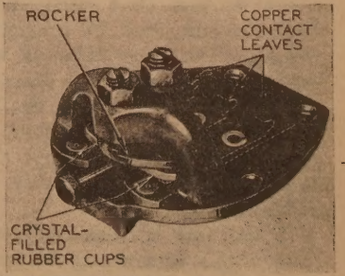


Fig. 1
A cross section of the pickup.

of an audio stage to the radio set, or certain changes in the detector tube circuit so that it might be used as an amplifier.

With this idea in mind, this new pickup was developed with an output large enough so that the single audio stage would provide the necessary amplification to obtain full power output of the



Compare this view with Fig. 1. The resistance of copper-oxide crystals in two soft-rubber cups varies as a rocker compresses first one cup then the other.

receiver. The output of this "copper-oxide" pickup is +10 db., as compared to only —15 db., for an average "magnetic" unit.

Also, the pickup is not a self-generating device as its predecessors of magnetic type. It consists of crystals of

(Continued on page 3)

REFLECTIONS OF A RADIO PIONEER

EARLY SUPERHET BUILDER

By Ray Windrix

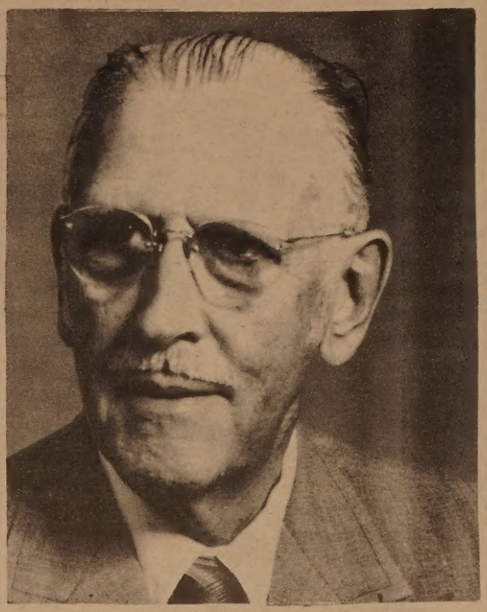
This fall I had the pleasure of meeting and talking with one of the true radio pioneers, in fact, as a research man, a pioneer in many fields. One of the prize radios in my collection is a super heterodyne kit set, model 112, manufactured by Dr. John Victoreen in 1924. At this time, I had the unique opportunity of taping a talk session with Dr. Victoreen, or "Dr. John," and of showing him my, or his, radio. I found Dr. Victoreen to be quite a distinguished gentleman in excellent health, very helpful and informative. It was quite a thrill listening to him tell of his involvement in the pioneering days of early radio, and of his later research in in many fields. I reiterate how very appreciative I am for the time Dr. John found to share some memories of the highlights of his past careers.

What follows is an edited version of our conversation:

"I was born in Pa. in 1902, and started in radio at the age of 17. Being largely self-taught, and always having been interested in physics, I had a fair sized laboratory. I started in 1919 in a very small way, before broadcasting of music and speech. I was one of the first radio amateurs to take the tests after WWI. I was very interested in vacuum techniques, vacuum and glass techniques being fields of their own. At an early age I built my own vacuum tubes.

The set you have here, model 112, became the popular set of its day, the best known kit set in the U.S. For that reason I was given the two center pages of the "New York Times," in blue as a blue print, giving instructions on how to put it together. Their radio department took over the editorial page for that issue, and this sold quite a few part kits all over the world. Thousands of sets were made. When I designed the transformer in that set, it weighed 4 pounds. Everybody thought I was crazy to put that much iron in a transformer, but it brought in low frequencies, the like of which no one else had at that time. That set had selectivity plus, and would go all across the country. You could pick up California from Cleveland on that thing, which was quite a feat.

I was one of the fellows who fought the Armstrong Super-heterodyne patent. When radio kits came out, RCA wouldn't grant a license to make them, even though they didn't know whether they owned the rights or not. RCA and AT&T wanted to settle this in court, in the meantime neither one would grant any licenses, which put me in a spot. We made more superhet. kits I guess than anybody else,

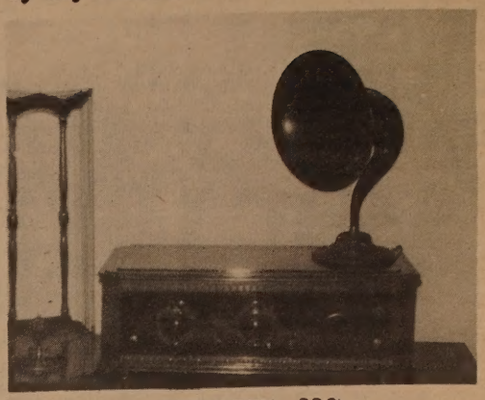


John A. Victoreen, 1975

then RCA sued my little outfit for the purpose of deciding who would be the owner of the patent. I had a chance then to go to the opposing group, AT&T, who offered me any of the experts from their engineering department, to provide me with the information that would help me win the law suit. But had I won, they would have owned it, and we would have been just as much in the soup. There was no real way out if two big companies of that size did have the patents on it. The long fight on the patent lasted for over 5 years. We were able to stall long enough for me to get out of the business before it came to court. We had knocked out one patent after another, but the Armstrong patent hadn't been decided on when I left, and Armstrong got it in the end.

I was at the first radio exposition ever given in Chicago in 1919, at the old Coliseum. There would be up to 75,000 people going through in one night. For that receiver, model 112, that you have there, we shipped one and a half tons of real lithograph blue prints 36" X 24". These were given away over the counter. We hired a troup of chorus girls dressed in tights to hand them out. By the time the doors closed that night, there was literature six inches deep on the floor of that entire building. People would grab a piece of literature, take a look at it, and throw it over their shoulder, but we didn't find a single one of those prints of mine. Everyone got one of those, they were really sought after.

Broadcast listening, or "BCL" as it was called, was the broadcast of speech and music. KDKA in Pittsburgh was the first station of this type in about 1920. Along with the kit set you have here, there was a power amp you could get, which was



VICTOREEN, 112

one of the first Hi-Fi amplifiers. When I built it, it had 450 volts center tapped on the transformer. Thorderson & Company who built most of the transformers in those days, came all the way down from Chicago to Cleveland and said, "Are you crazy, wanting to put a 450 volt transformer in a home receiver? What do you need that for?" I came out with the first high voltage power amplifier, we used big UX250s and 251s and had power for the first time. Some were used in the first movie theaters.

It's been a long time since I have seen a set like yours, but we built a variety of all types of radios. I would have really liked to have had you see the final receivers, they were beautiful things. They had condensor gangs for four log rhythmic condensors 14 inches long, 8 inches wide and 10 inches high, all ball bearings, with direct frequency on the dial in all aluminum casting. They looked like engine crank cases.

At the Victoreen Instrument Company in Cleveland, about five years age, I saw one for the first time in about twenty years. When I got out of radio, I got out completely, I hadn't been back there since. They took me up to the Board Room and had one of my old radios sitting there, looking just like new. I wanted to make radios more scientifically and was getting more and more scientific, when the tendency was to make them cheaper and cheaper, so we had a head on clash. I was getting disillusioned, things were going by the way of cheap radios. When the crash hit, our receivers sold for $750.00, this was with turntable combinations, in big beautiful cabinets. Competition was getting tough, when everybody was wanting two or three cheaper radios for $10 or $15. I was wiped out completely in 1929, and got out of that field, and into the field of physics.

I got into Xray measurement dosimetery for cancer therapy. At that time I made just the Xray dosimeters, first one then another variety. The Company grew and grew until I sold 80% of the

quality of the received signal is of the highest order, the esthetic value of the entire program may be lost. The nuances in sound which originate in the studio are veritable gems of tonality—precious baubles of compound frequencies to be handled with more than silk glove tenderness.

Of course, some of the technical subtleties which have made American broadcasting the star followed by foreign broadcast interests do not require the acme in program transmission facilities.

We refer especially to Ed Wynn's popular "so-o-o," which, Robert West tells us in his latest book, was caused by "mike fright"—the word "so" was in the script and during rehearsal the comedian's voice, thinned by fear, went falsetto; it was so funny Ed kept it in his repertoire. Another trick of the successful broadcaster is the inclusion of innate mannerisms, proclaiming indubitably that so-and-so is on the air; we refer especially to Jack Pearl in his characterization, "the Baron." For dialectician Jack's script reads: "Was you there, Charlie?" But it is the Baron's metamorphosis of the line which doubles us up when we hear the challenging query, "Vass you *dere*—Sharlie?"

However, there are still other types of studio transmission which do tax to the utmost the fidelity characteristics of a transmission system.

For instance, when sound-effects technician Ray Kelly of NBC pours a liquid (?) into a glass, a "velocity"-type microphone is used to insure that the characteristic tinkle, a composite sound due to the cascading solution and ringing vibrations of the goblet, will be picked up with utmost faithfulness.

The broadcasting of symphony concerts, so that they would sound "natural," was at first regarded as impracticable due to technical difficulties in transmission. Today, the engineering factors are under the thumbs of studio experts who manipulate sliding, sound-proofed walls, sound-control manuals, echo and reverberation time periods, timing of cues to the second, and even the applause of audiences to meet the power and frequency limitations of network transmission lines. The modern studio not only resembles a theatre—it far surpasses it in the versatility of control over the acoustic characteristics. The final, highly polished program is entrusted to the copper lines that tie the network stations to each other, with the knowledge that the trust will be met.

Not only must the esthetic value of novelty programs, and the texture of intricate orchestrations and musical gymnastics be unimpaired by any portion of the transmission system, but also the "spot" pick-ups from remote points must be transmitted with full fidelity.

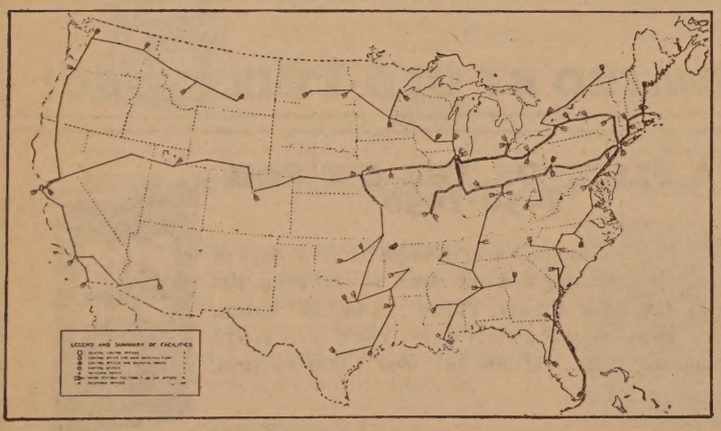
Fidelity in Remote Pick-ups

When the United States Fleet sailed majestically up the Hudson river, Paul White of CBS directed—from a special

(*Continued on page* 180)

Seven Chinese dialects "spoke" from "Frisco" to N.Y.C. (CBS)

Above. A tense moment, as Chicago's Stockyards went up in smoke. (CBS)



Typical operating layout of a coast-to-coast broadcast network. (Bell Tel. Co.)

Below. "Sound effects" require utmost transmission-line fidelity. (NBC)

master-control room in the headquarters of WABC, Columbia's key station—one of the largest operating crews ever assembled for a broadcast. He was in constant 2-way communication with numerous land, sea and air observation posts by means of an auxiliary short-wave circuit. As emergency set-ups of this nature ordinarily operate on the thin edge of speech intelligibility, any slight imperfection in the pickup would have impaired the program, but which turned out to be a tribute to chain broadcasting.

The 7,500 to 8,000 cycle band used by certain cleared-channel stations is utilized, and line transmission facilities are taxed to the utmost in certain pickups that feature the international slant. An excellent example was the recent CBS transmission over WABC, New York, in which the microphone was installed in a telephone exchange in San Francisco's Chinatown! The telephone numbers—or sometimes merely the names of the subscribers!—were shown by Loo Kern, Chinese manager of the exchange, to be called for in any one of 7 Chinese *dialects!*

Still another type of voice transmission, which requires for its efficiency the utmost fidelity in the entire network system, was the recent Chicago stockyards holocaust. The tensely gripping eye-witness story as told from atop the Illinois Bell Telephone Company's building, a half-block from the huge fire, was transmitted with all the spontaneous shadings of sound incident to the broadcast of what was a veritable national calamity. It was from this point that Chief Field Marshal Michael Corrigan told the world that the fire was under control.

Then there is that most remote of remote pickups, the Byrd Antarctic Expedition broadcasts from Little America, over 9,000 miles from New York, a half-hour program for which General Foods pays over $7,000. Every artifice is used to secure perfect pickup, via Buenos Aires, S. A., and South Schenectady, N. Y. Radio and telephone engineering were recently put to a crucial test to present to the audience of the 59 stations in the Columbia network the voice of Admiral Richard E. Byrd, as he flew in his airplane aloft the Antarctic Ice Cap!

However, although this was a record-breaking achievement in radio, the most brilliant jewel in the crown of radio broadcast network operation was the coast-to-coast tie-up of over 600 broadcast stations in a recent Presidential address to the people of the United States! Complete coverage of the entire country, from a desk telephone in Washington, D. C.!

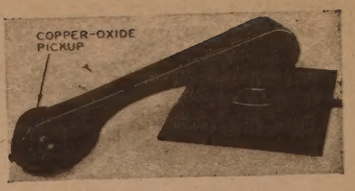
Inasmuch as our entire American broadcast structure depends for its efficiency upon the "mass" coverage that can be obtained by network operation, it follows that the thousands of miles of wire, and associated apparatus, required to join one station to another, constitute a most important link.

"Telephone" and "Broadcast" Cables

A *telephone message circuit*, such as Banker Smith would use in talking to New York and Chicago, inclusive, passes through 19 telephone offices, where "repeaters" or amplifiers renew the electrical energy lost in transit through the cable. To minimize the energy loss, 1,500 "loading coils" are located in the circuit at intervals of 6,000 ft. The two terminal offices are equipped to terminate or switch the circuit. The equivalent of only 1 employee's full-time services maintains this *telephone* or "private conversation" circuit. The wires can be arranged to provide a "phantom" circuit by means of which an additional "talking circuit" is obtained without the use of additional wires.

A *program circuit* designed only for carrying radio programs from point to point, on the

(Continued on page 4)



COPPER-OXIDE PHONO. PICKUP

copper oxide; the average resistance of the pickup is approximately 0.1-meg. No background noise whatever is developed. Its high resistance makes it possible to connect it directly into any radio set without any changes whatsoever. The operation of the set itself is not affected in the least.

This unit operates as a resistance that varies according to the motion of a contact arm which is rocked by the needle. This "variable resistor" modulates a steady D.C. potential that flows through it. The modulated voltage is applied to the grid of the output vacuum tube.

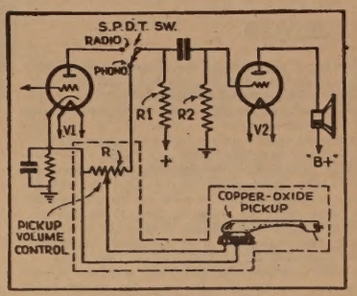


Fig. 3
Connections to the power tube in the set.

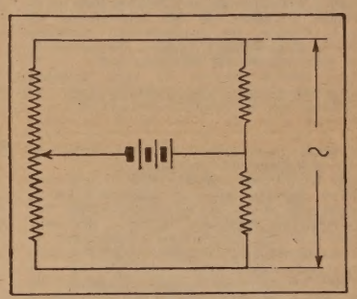


Fig. 2
Equivalent circuit action of the unit.

Figure 1 shows a cross-section of the pick-up, from which its simplicity can be readily seen. The oxide crystals provide the resistance element, which resistance varies with the pressure, approximately between 40,000 and 500,000 ohms. The output of the pickup will mainly depend on the voltage applied across this resistance. Although 25 volts is enough to obtain a large output, 250 volts can be used without burning or baking the oxide crystals. The pick-up in construction, is very similer to a double-button microphone. That is, it consists of 2 resistance elements that simultaneously vary in the opposite direction. (The resistance of the crystals in one cup is increasing while the resistance of the crystals in the other cup is decreasing.) These 2 elements can be used in the case of push-pull output tubes. In the case of single-tube output, only 1 element (cup) is used and gives equally good performance. The voltage and current—less than 1 ma.—is obtained from the "B" supply. This small current can hardly be considered a drain, even on battery-operated sets. Figure 2 shows the equivalent circuit of the pickup. Figure 3, the simplest method of connecting to any radio set regardless of make, model or year of manufacture. The pickup is always connected to the tube preceding the power stage.

The construction of the pickup unit is a radical departure from the magnetic type. (1) It is simple and rugged. (2) Proper dampening makes it possible to eliminate all resonant peaks—such peaks are the cause of poor reproduction. (3) Contrary to the magnetic pickup, the response does not fall at the lower frequencies but shows a marked rise. It is, therefore, unnecessary to use filters or any additional apparatus in the amplifier of the radio set to obtain the lower frequencies. The reproduction is not mechanical—but real. The combination of the radio set and pickup give a straight-line output.

The die-cast construction eliminates tone arm resonance. Ball-bearing pivots give free motion to the arm resulting in perfect tracking. Long record life is obtained by the exceedingly low weight on the record—less than 2 ozs. (magnetic units, for the same bass response, require a pressure of 3 ozs. and more).

output of it to G.E. So I became very well acquainted with them, and developed a number of things for them, which the public would never know, as it was done as a favor. I had become very close to the top management in the G.E. Xray Corporation. For example, when they came out with automatic film processing for Xray Departments, they needed water temperature control in large volumes like five gallons per minute, over tremendous ranges of hot and cold water intake, to be held to a half degree in output. This was something no-one could do. They asked me if we could do it, I didn't know if we could or not, but I tried and found that we could.

I made probably one of the first electronic stethoscopes in the U.S. for G.E. We made a good one, but it turned out to be the wrong thing to do, as I had warned them. No doctor wanted to admit that he had a hearing problem. So we couldn't sell them to doctors, which we thought would be the market for them, and it just died a natural death.

Having my sales outlet largely through G.E. we worked very well together. When the war broke out, I was then the only manufacturer of radiation measuring instruments in the world, so my company became one of the first prime contractors for the A-Bomb project. We were involved in the A-Bomb project even before the Army. My little company may have been small, but it was all they had, and I guess we did as well as anybody else in those hard times. We were set up in Cleveland under a secret contract to manufacture vacuum tubes, and instruments to measure radiation in the field by the Army, Navy and Air Force, in case the bomb was dropped on us. I was the only one who had the technology on the subject, because of our experience in the Xray dosimeter field. I went through all this in times of great secrecy. Such things as being asked to go out and buy a piece of

BETWORK

other hand, requires the use of larger and heavier wires than those used for telephone conversations. Also, owing to the exacting requirements of the broadcasting network service, loading coils must be installed at 3,000 ft. intervals. In addition, the special amplifiers employed for network purposes total more than twice as many as do the ordinary amplifiers or repeaters in the message circuit—40 as compared to 19. At 10 of the 23 offices through which the program circuit passes, provision must be made to feed the programs to radio stations, terminate the circuits or switch them. The equivalent of 15 technical employees' full-time service is required to maintain a *program* circuit! Furthermore, neither phantom nor carrier circuits can be operated in connection with program circuits.

For everyday telephony, a circuit which will transmit a frequency range of 3,500 cycles is generally sufficient for full intelligibility of speech. Circuits for entertainment purposes, however, require that a range of frequencies at least 8,000 cycles wide be transmitted.

Also, circuits designed for radio program transmission must be designed to take care of a considerable variation in volume or loudness. Otherwise, cross-talk, overloading of the equipment in the circuit which would produce "blasting" of the reproduction, and the production of undesirable frequencies would result.

Still another effect encountered in broadcast network operation is "delay distortion," due to the different degree of time required for the high and low notes to travel over the same copper-wire circuit. Correction circuits must be used to compensate the distortion which otherwise would result.

These limitations have been surmounted in circuits that operate over an audio frequency band of 5,000 to 8,000 cycles, for ordinary broadcast network requirements. Also, for special occasions ("Third Dimension in Music," RADIO-CRAFT, May 1934, pg. 654), transmissions have been made over a band of 15,000 cycles. And short-distance demonstrations have been given of cable transmission over a frequency band width of 45,000 cycles.

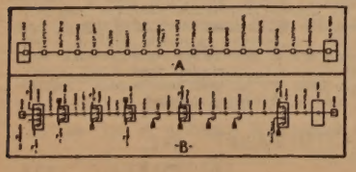
A New Era in Radio

Whereas the Federal Radio Commission was limited to operation in the radio field, the newly formed Federal Communications Commission will rule the largest group of communications companies in the world—including regulation of telephone and telegraph, as well as radio.

Surely, this new regime of coordinated effort promises radio programs both sustaining and sponsored, more desirable than any that have gone before. The first step has been taken in the granting of experimental licenses to four organizations desirous of developing the newly-opened "high fidelity" channels which permit operation on a frequency band 10,000 cycles wide. Practical work in this new field is scheduled to start in September. The writer witnessed the demonstration of third-dimension in music (and speech), and is in position to forecast that with the advent of high-fidelity transmissions radio will enter a new era of unprecedented popularity.

It does not take a wide stretch of the imagination to foresee the use of these wide-frequency channels for all broadcasting, after the first experiments have been completed. A review of technical developments in recent years aptly demonstrates the demands of the American people when they are educated to appreciate better things. And there is little doubt that after certain technical difficulties have been surmounted, the vastly superior quality possible with wide-frequency transmission will be in great demand.

Comparative operation of cables.



VINTAGE RADIO HAS GREAT BOOKS FOR YOU!

RELAX WITH A TIME TRIP TO YESTERDAY!

Thousands have already discovered the pleasure of owning Vintage Radio books. You too can enjoy browsing through those pioneer days of wireless and radio. You'll recapture the excitement of wireless days even though they were long before your time. You'll see fine old battery radios of the 1920's, and rediscover "cathedral" radios of the 1930's. You'll relive the dawn of radio broadcasting, visit the radio operator aboard his ship, visit G. I. Joe in his foxhole with his handy-talkie set, and meet the radio "Ham" in his shack.

These experiences and many more await you in Vintage Radio's family of books. Young or old, you'll be fascinated by your journey through those earlier days. You'll also discover the fun and rewards of collecting old-time radio sets and memorabelia.

We have received many enthusiastic letters and book reviews. Some samples may help your enthusiasm too:

"It's a fine, mouthwatering collection . . ."
"So order a copy! You'll love it."
" . . . fascination in every page."
"It brought back fond memories."
"You have the ONE mailing list I'm happy to be on."
"I am enjoying it thoroughly."
"Thrilled over all the pictures . . ."
" . . . educational and delightful."
"Your new book is great. Thank you very much."
"I unwrapped it and I did not lay it aside until five hours later."

YOU'LL BE FASCINATED BY OLD-TIME RADIO!

VINTAGE RADIO 1887-1929

You'll enjoy this fascinating pictorial story of pioneer days in wireless and radio. Relive the days of Marconi, old spark transmitters, and the struggles of early radio broadcasting. It's the radio collector's reference, with over 1,000 pictures on 263 pages.

HARD-COVER $7.95
HANDBOOK $5.95

A FLICK OF THE SWITCH 1930-1950

Here's your time trip through the great days of radio broadcasting and the dawn of television. Revisit the Lone Ranger, Philco "cathedral" radios, old "Ham" days and many more. You'll revel in 312 pages of story, old ads and over 1,000 pictures.

HARD-COVER $9.95, HANDBOOK $6.95

1927 RADIO ENCYCLOPEDIA

Own this authentic reproduction of Gernsback's classic. Browse through radio's heroes (who's Marconi?) and hardware (what's a coherer?) of the old days. 175 fascinating pages. Our hard-cover version is a serialized limited edition, an ideal gift.

DELUXE HARD-COVER $12.95, HANDBOOK $9.95

DISCOVER THE EXCITING RADIO COLLECTOR'S HOBBY!

land using my own name and money. Very few people would have done that, and it was agreed that they would act as if they didn't even know me. I did it, and it worked out. There were some very complex and threatening things that developed during the war, and naturally there was one hazard after another, but I went through it: not without nearly becoming a nervous wreck. I have been asked to write a book about my experiences on that project, but that's one story I'll never tell.

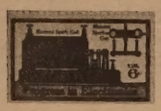
I was interested in truely scientific things that radio didn't quite satisfy. When the war was over my company built all the commercial radiological instrumentation for the Bikini Bomb test and the Eneweitor Bomb test. We built it all. There were two boxcar loads and one C-47 plane load that we had to make in a matter of 7 weeks. All this had to be developed from scratch as they had never been built before. After the A-Bomb project, a Cleveland University gave me an honorary doctorate for the things I had done on that project. Of course one rarely uses such a title, but I became, nevertheless, affectionately know to most people in my field as "Dr. John."

I came to Colorado Springs in 1950 and stayed until 1962. I joined the Staff at the Medical Center as consulting physicist and also Memorial Hospital, helping them build their isotone department.

Being interested in audio and audio power amplification and frequency response, etc., I ended up in what is today my field, otometry. You could say that I am the "Father of Otometry." I have written three books on the subject, which have to do with prosthetic hearing instruments for hard of hearing people. My work in the audio field of radio has given me the background I need to solve the problems and needs of the otometry field. I give at least four seminars per year on prosthetic applications of hearing instruments.

1976 ad

OUR BOOKS AREN'T ALL - WE'LL BEAUTIFY YOUR WALL!



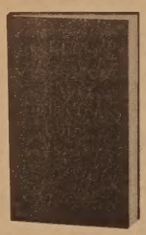
MAGNIFICENT COLOR PRINTS FROM ORIGINAL ART

These fine "Progress in Electronics" prints are the most striking artwork we've seen in years. Made from the original painting, each print is 8" x 10" with its own coordinated matte background. Prints are on beautiful heavy stock with high-quality inks. It takes nine passes through the printing press to make each of these four masterpieces!

You have a choice of prints for framing, or plaques ready to hang on your wall. Originally conceived as executive gifts by Hall-Mark Electronics, these fine pictures are made by special arrangement with the U.S. Postal Service. Here's the ideal holiday gift for you, your relatives and friends!

FOUR BEAUTIFUL PRINTS FOR FRAMING, $7.50. READY-TO-HANG PLAQUE SET, $18.50

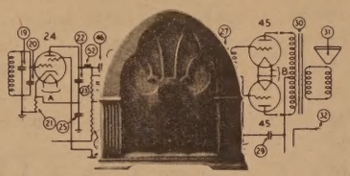
1921-1932 RADIO COLLECTOR'S GUIDE



This book makes you an "instant expert" as you go prospecting for those fine old radios. It eliminates guesswork in determining a set's age and "pedigree." There are 264 pages loaded with over 50,000 facts on 9,000 radio models made by 1,100 manufacturers.

HANDBOOK $4.95

CIRCUIT DIAGRAMS



We will research any pre-1951 radio model and send you the circuit diagram and any other available repair information. We'll also tell you the year in which that model was introduced. Your money back if we don't come up with at least a circuit diagram!

We now have Canadian diagrams, too!

ANY RADIO MODEL $3.50

MOST-OFTEN-NEEDED 1926-1938 DIAGRAMS

This reprint of Morris Beitman's Supreme Publications book shows circuit diagrams for 600 radio models. Its 240 pages are valuable for historical circuit information, and are great aids in restoring those old sets. Made from Supreme's original artwork, it is clear and readable.

HANDBOOK $7.00

THE SOONER YOU ORDER, THE SOONER IT'S YOURS!

Send check or money order to Vintage Radio, Dep't D, Box 2045, Palos Verdes Pnsla., CA 90274
TEN-DAY GUARANTEE. WE PAY POSTAGE. Californians add 6% Sales Tax.

_____ $ _____ _____ $ _____
_____ $ _____ _____ $ _____
_____ $ _____ _____ $ _____
_____ $ _____ _____ $ _____
Total $ _____

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

Vintage Radio

FREE! Radio Age Guide with Each Order. FREE!

Vintage Radio

1932 ad

The Public Approves

These Sensational Low-Priced

CROSLEY

SUPER-HETERODYNES

$29.75

***The Crosley* TYNAMITE**

The gem of all radio receivers! The attractive cabinet is of fine selected woods, carefully finished and high-lighted. The 4-tube superheterodyne chassis incorporates pentode output, variable mu, image suppression pre-selector, combined volume control and on-off switch, illuminated station selector. Full floating moving coil dynamic speaker is used. Dimensions: 13½" high, 9¾" wide, 7½" deep. A low-boy console model, The BONNIBOY, housing the same chassis, sells for $39.75.

***The Crosley* LITLFELLA**

The walnut veneer front panel of this exquisite receiver is arched with oriental veneer and is supported at the sides with delicately fluted pilasters. This superheterodyne incorporates five tubes, pentode output, variable mu, continuous (stepless) tone and static control and on-off switch, volume control, illuminated shadow dial with vernier drive and dynamic speaker. Dimensions: 17" high, 13" wide, 8½" deep. The BIG-FELLA, console for $48.48 and The PLAYTIME, Jr. grandfather clock model for $79.75 incorporate the same chassis. Details of entire line from your Crosley Distributor.

$36.36

Montana, Wyoming, Colorado, New Mexico and west, prices slightly higher.

The Crosley Radio Corporation
Powel Crosley, Jr., *President*
Home of "*the Nation's Station*"—WLW
CINCINNATI

I was a pioneer in radio, and am just as much a pioneer in this field, because I stand for change; but people seem to want the status quo. The three books I have written on otometry are "Hearing Enhancement in the '60s," "Basic Principles of Otometry" and I have, coming up shortly, one titled "Hearing Instrument Dispensing by Prescription." I am trying to promote the use of prescription, with the whole hearing industry violently opposed to this ever coming about, because then they would have to make things right and guarantee them. Neither of these things do they want.

I am now doing research as Victoreen Laboratory, in Maitland, Fla. The former company, Victoreen Instrument Company, is still in Cleveland, but has been expanded so many times that I am completely out of it. I am not as much a businessman as a research man."

With that, Dr. John concluded his comments. After 56 years as a true pioneer in a vast variety of technical fields, he is still pioneering. He is still trying to make this a better world. We can only say "Thank you, John Victoreen, for all the pleasure you have brought us."

Club News

SOUTHWEST VINTAGE RADIO AND PHONOGRAPH SOCIETY

Mel Zemek, recognized by his sense of humor and leadership in the Society, will reward it with a talk about the history and developement of the vacuum tube, starting with the 01 and 99. Mel is fond of National receivers and he will speak about the history of them.

Mel has adequate credentials for speaking about old sets. When he was only 15 he helped as a shipboard operator aboard the steamship Manhatten. He has held an amateur license since 1934, he is W5IK. He even belongs to the Quarter Century Wireless Association and the Old Old Timers Club.

The Society is expecting the talk to be of interests to the novice collectors and historians as well as the pros.

FINDS OF THE MONTH

My father, who I had previously asked to keep an eye out for early Radio/Wireless equipment, was at a Swap-Meet and happened to run upon a box of fairly recent radio parts. However, after digging through this box, found at the bottom a 1918 Signal Corps Spark Transmitter, built by Connecticut Telephone & Electric Model SCR-65. The unit is in fairly good condition, and he paid $2.00. WOW!

I find your publication very interesting, and always look forward to receiving my issue. I find your "MART" column particularly helpful.

Keep up the excellent work.

Yours Truly,
Paul M. Crozier
521 Sheridan St.
Modesto CA 95351

My find of the month is a home brew job with an AMCO tripple slide tuner. It was in barn condition but I have fixed it up. It has 2 brass base, glass tipped 01A's and a 200 in UV type sockets. I paid $2.00 for it!

RCA still supplies schematic info for all old radios. About 2 years ago I wrote RCA Service Company, Camden, N.J. 08101. They sent me 3 pages of info on the Radiola III. They have also sent me info on other very old radios. I believe the cost was about $2.50 for this info. As far as I know RCA is the only company who still can send info on very old radios.

Larry Babcock
8095 Centre Lane
E. Amherst, N.Y. 14051

LETTERS

I just wanted to drop you a note to thank you for printing my letter in the Find of the Month column last month. I was really happy with the response to my questions on the Radiola III, I did not expect to hear from so many people. I appreciate your taking the time to forward their letters to me & I am enclosing $1.00 to help cover the postage cost you have incurred. Once again thank you much & keep up the good work.

Sincerely,
Jim R. Steele
P.O. Box 568
Tomah, Wisc.
54660

We are working with a backlog of articles. Please wait, if yours has not been published yet.

We need an article about the Busy Bee phonographs.

Ad deadline: the 20th of the preceding month.

1922 RADIO ROUTINE

JIMMIE BARRY, WGAR, Fort Smith, Ark.--Jimmie relates the station routine of 1922 when he was 15.

The first thing we did on opening the station at about five o'clock each afternoon was to ask if anyone was listening. "This is WGAR, the Southwest American station, located in Fort Smith, Ark., at the foothills of the Ozarks, the Playground of America. We wonder if anyone is listening. How about Glen Masters? Are you listening, Leon Hudson? I wonder if Loy Williams is home yet." The telephone would ring.

We would take off our single-button microphone and hang it in front of the Edison phonograph and put on a record. A listener would call and say we were coming in fine.

Sometimes one of our listeners would have trouble with his receiving set. We would announce the fact and promptly lose all our listeners. They would go to the home of the owner of the defective set to help with repairs.

From the bulletin , Oldtime Announcers Club, Broadcast No.1, P.O. Box 1174, North Little Rock AR 72115.

MART

Classified ad rate: 6¢ per word.
Photo ads: $2.00 extra.

FOR SALE OR TRADE

ALL COLLECTORS: Assorted phonograph parts: Repair phonographs, pump organs, player pianos, radios etc; Antique radio tubes, 01A, 26, 71A, etc: 20 cylinder records: Wire recorder: Post office boxes w/brass doors: Antique telephone, wood box: Player piano rolls: Used sound equipment: 3 lbs. mercury: G.E. Manual 1939-42: Movie projector, 16mm, some film: Wurlitzer juke box, 45rpm records: 22 volt Delco light plant: Windcharger parts: Windcharger w/Exide batteries: MC300 National receiver: Sam's photofacts, up to 1012: N.R.I. manual: Rider Manuals: One-1, 4, 6, 7, 8, 9, 10, 15, 18: two-test equipment--Knight RF sig. gen. KG650--Tripolet sig. gen. 3433--Precision App. sig. gens. 200 & 200C--field strength meter, Radion Corp. --Sylvania #145 audio sig. gen.--50-10,000, PS 403BO audio sig. gen.--automatic voltage transformer, Acme Electric 18111--VTVM D & K Model 177--VTVM polymeter, Sylvania 134--resistance-capacitance bridge Eico 950. Sam Price, 1102 N. Chadbourne, San Angelo TX 76901.Pho: 915 653-1720.

FOR SALE OR TRADE: Scarce first Hallicrafters "Sky Rider" Regen. Receiver 1934 by Silver Marshal and a WWZ Suitcase "Spy Radio." If interested send SASE for photos etc. AK power supply unit with tube, cord etc., for model 40 Exc. $20. Harold L. Hasbrouck, 1157 Palms Blvd., Venice CA 90291.

NEW
PUETT ELECTRONICS
P.O. BOX 28572 DALLAS TEXAS 75228

THE FOLLOWING BOOKLETS -- $2.00 EACH POSTPAID:

(1) THE ACQUISITION OF ANTIQUE RADIOS
(2) THE COMPLETE RESTORATION OF BATTERY POWERED ANTIQUE RADIOS
(3) THE COMPLETE RESTORATION OF AC POWERED ANTIQUE RADIOS

SEE OUR NEW LIST ON THE BACK COVER OF THIS ISSUE OF THE HORN SPEAKER

1976 AD

FOR SALE OR TRADE

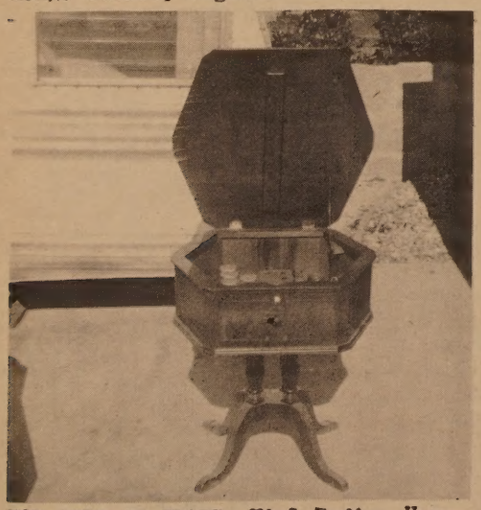
WIRELESS * SPARK accumulated before the war. State serious interests. SASE for reply.
Norman Machinery Works, c/o David Ashbaucher, P.O. Box 2614, Norman, Okla., 73069.

CLEANING OUT CLOSET: Misc. telegraph items, early wireless and electrical magazines (1909 - 1914) and some wireless items inc. loose coupler etc. Send SASE for list.
Guy Martin, P.O. Box A, Azusa, California 91702.

"RADIO AGE," a radio magazine devoted to wireless and early broadcast eras. Contains interesting articles written by collectors, articles published in early radio magazines, lots of reprints of famous radio ads, and a classified section for buying or selling radio and electronic items. Subscribe at $7.50 per year for ten issues.
Mail check or money order to Radio Age, 1220 Meigs Street, Augusta, Georgia 30904.

FOR SALE OR TRADE: Early QST's, CQ's, Radio, call books, handbooks, tubular Audiotrons, Electron relays and early receivers & parts. Erv Rasmussen, W6YPM, 164 Lowell St., Redwood City, California 94062.

FOR SALE: Authentic reprint of A.H. Grebe sales brochure. Includes many pictures and descriptions of CR-3, Cr-5, CR-8, CR-9, RORK and RORD, $2.25 ppd.
Authentic reprint of A.H. Grebe Instructions for operating. Contains 64 pages of hook-ups, schematics and graphs for CR-3, CR-8, CR-9, RORK, RORD, and RORN, $3.95 ppd. Mail check or MO to Don Patterson, 1220 Meigs Street, Augusta GA 30904.



FOR SALE OR TRADE. Kiel Radio. Hexigon Duncan Phyte cabinet need repair. Best offer. Charles Seidel, 614 Grove Lane, Santa Barbara CA 93105. Phone: 805 687-7967. Many other old radios.

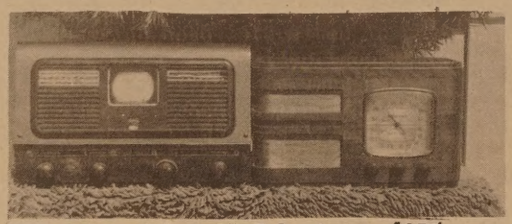
FOR SALE: Detailed, 11 X 14 schematic of Federal 61, offset printed. This schematic is not in any of the early service manuals. $2.50 ppd. Bill Condon, 1434 Princeton, Apt. B., Santa Monica, Calif. 90404.

FOR SALE OR TRADE

ANTIQUE TELEVISION Collection: 38 different models from 1930s, 1940s one or all $75.00 up each. List & picture $1.00. Seidel, 614 Grove Lane, Santa Barbara CA 93105. Phone; 805 687-7967. Want horn phonographs any quanity CASH.

SELL OR SWAP: Battery and electric radios, speakers, tubes, books, literature including Riders, misc. SASE for list. Steve Meyerkorth, 2208 S. 50th Ave., Omaha NB 68106.

$1.00 for the newly published booklet "A Pocket Guide to Antique Radio Collecting." Antique Radio Press, Box 42, Rossville IN 46065.



FOR SALE: Pilot 3" Television $275. RCA Radio $60.00. More radios. Many televisions from 1930s-1940s. WANT horn phonographs, old radios and televisions. Charles Seidel, 614 Grove Lane, Santa Barbara CA 93105. Phone: 805 687-7967.

FOR SALE OR TRADE; SAMS Photofacts 51-222 in 11 hard binders, 223-816 in steel cabinet.
WANTED: Old Crosley Radio cabinet. Lee Kemp, RFD 10, Frederick, Maryland 21701. Phone: 301 662-3482.

BLANK BAKELITE STOCK cut to size, 1/8" to 1/2" thick. Fabricating and engraving services available. SASE for pricing sheet.
Norman A. Parsons, 22 Forest St., Branford CT 06405. Phone: 203 488-4267.

WD11 Adaptors, use UX199, 120, VT24. No wiring changes, Radiola III's battery hook-up included $5.25pp., 2 for $9.25. Keith Parry, 17557 Horace St., Granada Hills CA 91344.

TRADE: Aeriola Sr, Radiola III, AK 20 compact, Thermiodyne TF5. Will swap for radios I don't have. Alvin Heckard, RD 1, Box 88, Lewistown PA 17044.

MAIL AUCTION:
1. Atwater Kent 10 Breadboard.
2. Atwater Kent model 49.
Stephen E. Davis, 809 W. Ave. F, Garland TX 75040.

FOR SALE OR TRADE

RADIOS FOR SALE: Specify your needs or send $1.00 and SASE for list. Refundable. Radio Americana, Box 128, Woodstock, N.Y. 12498.

WANTED

WANTED: BOOKS: Television - Seeing by Radio or Wireless. Dindsdale A. ABC of Television or Seeing by Radio, Yates R.F. Television for the Home - The Wonders of Seeing by Wireless, Hutchinson, London. All About Television including experiments, Secor H.W. and Kraus J.H. Wireless Pictures and Television., Baker T. London.
Darcy Brownrigg, Chelsea, Quebec, JOX 1NO, CANADA.

WANTED any information on "Fleetwood" Radio made by Freshman for export to Canada. Looks same as Freshman-Masterpiece, page 89, Vintage Radio. Darcy Brownrigg, Chelsea, Quebec, JOXINO CANADA.

WANTED UNASSEMBLED KIT radio in original box. Boxed parts of any kind. Sets, parts, books, magazines of the 1920s. W6ME, 4178 Chasin St., Oceanside CA 92054.

WANTED: Crystal sets, battery and electric radios and televisions Mfg. before 1935. Need all related items. Will buy one set or complete collection. Young, 11 Willow Court, Totowa, N.J. 07512.

WANTED: Radio - all 1920, 1921, Oct. 1922. Many wireless age 1920, 1925, Q.S.T. Feb., March 1920. Radio Craft Aug., 1929, Feb., 1931. Thompson, 2930 Delavina, Santa Barbara CA 93105.

WANTED: Old microphones with springs, crystal radios, horn type phonographs, early mechanical toys. Please send photo if possible and best price and condition. Leonard, P.O. Box 127, Albertson, N.Y. 11507.

WANTED: Beginning collector interested in your duplicatee, crystal sets, early radios, horn speakers, etc. Any condition. Tree, 111 Skyline Dr., Morristown, N.J. 07960.

WANTED: Scott, McMurdo Silver, Lincoln receivers, also paper work on same. J. Cunningham, 23 W. 675 Ardmore, Roselle, Ill. 60172.

WANTED: Baldwin type C headphones. Good to excellent condition. K. A. Ladd, 7525 Wentworth Ave., Richfield, Minn. 55423.

WANTED: "Mystery Control" (Remote telephone dial type) for Philco 39-116. Robert Campbell, 5068 Franklin Ave., Apt. 209, Los Angeles CA 90027. Phone: 213 661-5805.

WANTED: Zenith Trans-Oceanic model 7G605. In any condition. Louis Yadevia, 601 Church La., Upper Darby PA 19082.

WANTED: National SW-3 with coils. Pay top price for good one. Please give price and details in first letter. J. Alford, 3184 Lockmoor, Dallas TX 75220.

PUETT ELECTRONICS | PUETT ELECTRONICS | PUETT ELECTRONICS | PUETT ELECTRONICS | PUETT ELECTRONICS | PUETT ELECTRONICS

PUETT ELECTRONICS

P.O. BOX 28572 DALLAS TEXAS 75228
PUBLISHERS OF
THE CLASSIC RADIO NEWSLETTER

LIST NO. 15

HOW TO ORDER

(1) Make checks and money orders payable to PUETT ELECTRONICS.
(2) Please state whether new or half-price used tubes are desired and whether a used tube may be substituted when a new tube is out of stock. REFUNDS are mailed with your invoice for out-of-stock tubes, or when, by customer request, a used tube is substituted for an out-of-stock new tube.
(3) WE SHIP PARCEL POST. NO C.O.D. INCLUDE 15% POSTAGE & HANDLING PLUS 30¢ INSURANCE. TEXAS RESIDENTS ADD 5% STATE SALES TAX. MINIMUM ORDER $3.00 - does not apply to schematic diagrams or lists.

CUSTOMER SATISFACTION GUARANTEED - If you are not satisfied with your order for any reason, tubes may be returned within ten days for refund or replacement with exception of tubes which are shorted or have open filaments. It will be assumed that returned tubes with open filaments or shorts were damaged in shipment. Shipping damage claims will be handled promptly through the post office on insured orders. PUETT ELECTRONICS assumes no liability for orders which are not insured, and no liability beyond that which is covered by postal insurance. ALL TUBES ARE THOROUGHLY TESTED ON A MUTUAL CONDUCTANCE TUBE CHECKER BEFORE SHIPMENT.

THE CLASSIC RADIO NEWSLETTER
successor to
The Scott News & The Silver Times

SEND 13¢ STAMP FOR A SAMPLE OF OUR CLASSIC RADIO NEWSLETTER - SIX ISSUES PER YEAR - FOUR OR MORE PAGES PER ISSUE.

SCHEMATIC DIAGRAMS

WE CAN FURNISH SCHEMATIC DIAGRAMS AND TECHNICAL DATA ON ALMOST ANY RADIO FROM 1920 TO 1954 FROM OUR LIBRARY OF ORIGINAL MANUFACTURERS SERVICE DATA. Send $1.50 and one 13¢ stamp per radio set. This offer is limited to five photo-copied pages. If the data you seek exceeds five pages, we will send you a quote. BE SURE TO STATE MANUFACTURER'S NAME AND MODEL NUMBER.

TUBE TYPES 01A, 99 & WD-11 etc. We sometimes have these tubes in stock in limited quantities. Send a 13¢ stamp for our latest New Acquisitions List.

BALLAST TUBES - We can supply many types of ballast tubes or their equivalents. Send 52¢ in stamps for our Catalog Section.

OLD RADIO TECHNICAL BOOKS
Send 13¢ stamp for our New Acquisitions List.

THE PUETT ELECTRONICS SUPER ANTENNA - GROUND SYSTEM
For antique radios and short wave listening, high gain, takes up very little space, omni-directional, tested & proven - plans $2. post pd.

LIST OF ANTIQUE RADIO SERVICES
Over 80 sources for services, parts, tubes & data - $1.50 plus 13¢ stamp.

TUBE TYPES AND PRICES -- Prices listed for new tubes - used tubes, when available, are half the new tube price.

0A2	$2.	1LE3	$4.	5Y4	$3.	6F6	$3.	6U7	$4.	7Z4	$3.	14B5	$3.	35W4	$2.	81	$6.	5654	$2.
0A3	$2.	1LF3	$4.	5Z3	$3.	6F7	$6.	6V6	$2.	10	$6.	14B6	$3.	35Y4	$3.	82	$3.	5686	$3.
0A4	$2.	1LG5	$4.	5Z4	$3.	6F8	$3.	6V7	$4.	12A5	$4.	14B8	$3.	35Z3	$3.	83	$3.	5691	$3.
0B3	$2.	1LH4	$4.	6A3	$5.	6G5	$4.	6W6	$3.	12A6	$3.	14C5	$3.	35Z4	$3.	83V	$3.	5703	$3.
0C3	$2.	1LN5	$4.	6A4	$6.	6G6	$3.	6X4	$2	12A7	$4.	14C7	$3.	35Z5	$3.	84	$3.	5749	$2.
0D3	$2.	1N5	$4.	6A5	$4.	6H6	$2.	6X5	$2.	12A8	$3.	14E6	$3.	35Z6	$3.	85	$3.	5751	$2.
0Y4	$3.	1N6	$4.	6A6	$4.	6J5	$3.	6Y5	$3.	12AH7	$3.	14E7	$3.	36	$3.	89	$3.	5814	$2.
0Z4	$2.	1P5	$4.	6A7	$5.	6J6	$2.	6Y6	$2.	12AT6	$2.	14F7	$3.	37	$3.	117L7	$4.	5879	$2.
1A1	$5.	1Q5	$4.	6A8	$3.	6J7	$3.	6Y7	$2.	12AT7	$2.	14F8	$3.	38	$3.	117M7	$4.	5881	$2.
1A3	$3.	1R5	$2.	6AB4	$3.	6J8	$3.	6Z4	$3.	12AU6	$2.	14H7	$3.	39	$3.	117N7	$7.	5992	$2.
1A4	$3.	1S4	$2.	6AB7	$3.	6K5	$3.	6Z5	$2.	12AU7	$2.	14J7	$3.	40	$6.	117P7	$7.	6080	$3.
1A5	$3.	1S5	$2.	6AC5	$3.	6K6	$3.	6Z7	$2.	12AV6	$2.	14N7	$3.	40Z5	$2.	117Z3	$4.	6146	$4.
1A6	$3.	1T4	$3.	6AC7	$3.	6K7	$3.	6ZY5	$3.	12AX7	$2.	14Q7	$3.	41	$3.	117Z4	$4.	6188	$3.
1A7	$3.	1T5	$3.	6AG7	$3.	6K8	$3.	7A4	$3.	12B7	$3.	14R7	$3.	42	$3.	117Z6	$4.	6842	$2.
1B4	$3.	1U4	$3.	6AK5	$2.	6L5	$4.	7A5	$3.	12B8	$4.	14W7	$3.	43	$3.	485	$4.	6973	$2.
1B5	$3.	1U5	$3.	6AK6	$2.	6L6	$3.	7A6	$3.	12BA6	$2.	14X7	$3.	44	$3.	807	$4.	7025	$2.
1B7	$3.	1Y	$4.	6AL5	$3.	6L7	$3.	7A7	$3.	12BE6	$2.	15	$5.	45	$6.	809	$6.	7193	$2.
1B8	$3.	2A3	$6.	6AL7	$4.	6N5	$4.	7A8	$4.	12C5	$3.	19	$4.	45Z3	$2.	837	$4.	9002	$3.
1C1	$4.	2A4	$5.	6AQ5	$2.	6N6	$3.	7AE7	$4.	12C8	$3.	19T8	$2.	45Z5	$2.	843	$3.	9003	$3.
1C5	$3.	2A5	$4.	6AQ7	$4.	6N7	$3.	7AF7	$4.	12F5	$3.	22	$5.	46	$6.	879	$2.	9004	$4.
1C6	$3.	2A6	$3.	6AS7	$3.	6P5	$3.	7AG7	$4.	12H6	$3.	24A	$3.	47	$5.	884	$7.	VR-	
1C7	$5.	2A7	$5.	6AT6	$2.	6Q7	$3.	7B4	$3.	12J5	$3.	25A6	$3.	48	$4.	923	$3.	90	$2.
1D5	$5.	2B7	$3.	6AU6	$2.	6R7	$4.	7B5	$3.	12J7	$3.	25A7	$3.	49	$4.	930	$3.	VR-	
1D7	$5.	2C26	$2.	6AV5	$2.	6S4	$4.	7B6	$3.	12K7	$3.	25AC5	$3.	50	$6.	950	$3.	105	$2.
1D8	$4.	2E5	$4.	6AV6	$2.	6S8	$3.	7B7	$3.	12K8	$3.	25B6	$3.	50A5	$3.	951	$3.	VR-	
1D21	$3.	2E30	$2.	6AX5	$2.	6SA7	$2.	7B8	$3.	12L6	$2.	25C6	$2.	50B5	$2.	955	$4.	150	$2.
1E5	$5.	2V3	$4.	6B4	$5.	6SB7	$3.	7C5	$3.	12Q7	$3.	25L6	$3.	50C5	$2.	958	$4.	VT-	
1E7	$4.	2W3	$4.	6B5	$5.	6SC7	$3.	7C6	$3.	12S8	$3.	25S	$3.	50C6	$3.	1005	$3.	52	$4.
1F4	$4.	2X2	$2.	6B6	$5.	6SD7	$3.	7C7	$3.	12SA7	$3.	25Z5	$3.	50L6	$3.	E11L8	$2.	XXB	$3.
1F5	$4.	3A4	$3.	6B7	$5.	6SF5	$3.	7E6	$3.	12SC7	$3.	25Z6	$3.	50X6	$3.	1201	$3.	XXFM	$3.
1F6	$4.	3A5	$3.	6B8	$3.	6SF7	$3.	7E7	$3.	12SF5	$3.	26	$4.	50Y7	$3.	1203	$3.	XXL	$3.
1F7	$5.	3A8	$3.	6BA6	$2.	6SG7	$3.	7F7	$4.	12SF7	$3.	26A6	$4.	51	$3.	1232	$3.		
1G4	$4.	3C6	$3.	6BE6	$3.	6SH7	$3.	7F8	$4.	12SG7	$3.	26A7	$4.	53	$5.	1273	$3.		
1G5	$4.	3LF4	$5.	6BJ6	$2.	6SJ7	$3.	7G7	$3.	12SH7	$3.	27	$3.	55	$4.	1612	$3.	MAJESTIC:	
1G6	$4.	3Q4	$3.	6C4	$2.	6SK7	$3.	7H7	$3.	12SJ7	$3.	28D7	$3.	56	$3.	1620	$3.		
1H4	$5.	3Q5	$3.	6C5	$3.	6SL7	$3.	7J7	$3.	12SK7	$3.	30	$3.	57	$3.	1625	$4.	G4S	$5.
1H5	$3.	3S4	$2.	6C6	$3.	6SN7	$2.	7K7	$3.	12SL7	$3.	31	$3.	58	$3.	1626	$3.	2A6	$4.
1H6	$3.	3V4	$2.	6C7	$4.	6SQ7	$3.	7L7	$3.	12SN7	$3.	32	$3.	59	$4.	1629	$4.	2B7	$3.
1J6	$4.	5AZ4	$4.	6C8	$4.	6SR7	$3.	7N7	$4.	12SQ7	$3.	32L6	$3.	70A7	$3.	1633	$3.	031	$4.
1L4	$4.	5R4	$2.	6CB6	$2.	6SS7	$3.	7Q7	$3.	12SR7	$3.	32L7	$2.	70L7	$3.	1634	$3.	6C7	$4.
1L6	$6	5T4	$2.	6D6	$4.	6ST7	$3.	7R7	$3.	12V6	$3.	33	$3.	71A	$6.	1635	$3.	6D7	$4.
1LA4	$4.	5U4	$2.	6D7	$4.	6SU7	$3.	7S7	$3.	12W6	$3.	34	$3.	75	$3.	1656	$3.	6E7	$4.
1LA6	$4.	5V4	$2.	6D8	$4.	6SV7	$3.	7V7	$3.	12X4	$2.	35	$3.	76	$3.	1852	$3.	46B1	$5.
1LB4	$4.	5V6	$2.	6E5	$4.	6T7	$4.	7W7	$3.	12Z3	$2.	35A5	$4.	77	$3.	1853	$3.	G46A1S	$5.
1LC5	$5.	5W4	$2.	6E6	$4.	6T8	$2.	7X6	$3.	14A4	$3.	35B5	$2.	78	$3.	2050	$3.	G6Z5	$3.
1LC6	$4.	5X4	$3.	6E7	$4.	6U5	$4.	7X7	$3.	14A5	$3.	35C5	$2.	79	$3.	2051	$3.		
1LD5	$4.	5Y3	$3.	6F5	$3.	6U6	$3.	7Y4	$3.	14A7	$3.	35L6	$3.	80	$3.	CK108	$3.		

COMPLETE CATALOG -- INCLUDES 10% DISCOUNT COUPON ON YOUR NEXT ORDER

SEND 52¢ IN STAMPS FOR OUR CATALOG SECTION. IN ADDITION TO TUBES AND SCHEMATIC DIAGRAMS, WE CAN ALSO SUPPLY KNOBS, DIAL ESCUTCHEONS, TUNING DRIVE BELTS, ANTIQUE TUBE CARTONS, OLD STYLE GLASS ENVELOPE TUBES, SPECIAL TUBES FOR TUBE COLLECTORS, ANTIQUE WIRE, MORE RECENT TYPE-NUMBER AND TV TUBES, SPECIAL SERVICE NOTES, ANTIQUE RECORD CHANGER DATA, ANTIQUE PA SYSTEM DATA, OLD STYLE TUBE SHIELDS, AND SOME ORIGINAL PARTS FOR SETS.

IF YOU DO NOT SEE A TUBE WHICH YOU SEEK LISTED, SEND A 13¢ STAMP WITH YOUR REQUEST. WE MAY BE ABLE TO RECOMMEND A SOURCE OF SUPPLY.

MILITARY TUBE TYPE (VT) VERSUS EQUIVALENT COMMERCIAL TUBE TYPE CROSS-REFERENCE LIST - Send $1.00 plus one 13¢ stamp.

We offer free technical advice for a 13¢ stamp for return postage or you may call J.W.F. Puett at 214 - 279-8309 NO LATER THAN 10:00 PM CENTRAL STANDARD TIME OR CENTRAL STANDARD DAYLIGHT TIME (when applicable) PLEASE.

SILVER GHOSTS
BY J.W.F. PUETT
PHOTOGRAPHS - SCHEMATIC DIAGRAMS-STORIES
OF EVERY KNOWN RECEIVER MANUFACTURED BY
THE E.H. SCOTT RADIO LABORATORIES
70 PAGES IBM PHOTOCOPY $0.00 POST.PD.
PUETT ELECTRONICS

We are trying to obtain enough orders to photo offset print Silver Ghosts instead of the originally advertised photocopy reproduction. We hope to go to press soon.

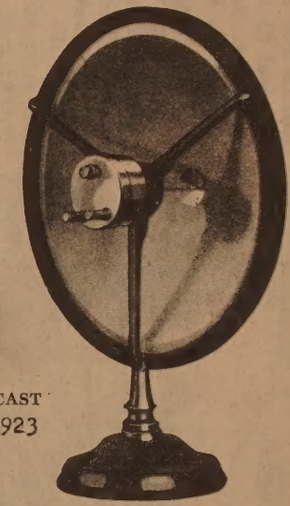
APRIL 75c

THE HORN SPEAKER

1976

THE AUDIOPHONE JR.

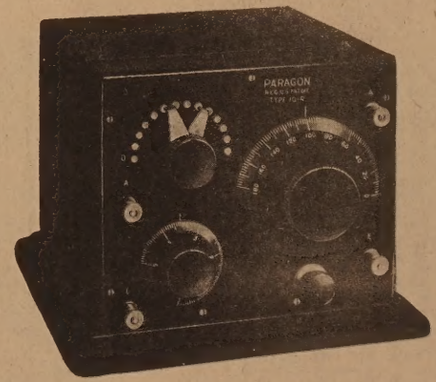
Made by the Bristol Company. A transformer is mounted in the base to provide proper coupling between the loud speaker unit and the output circuit of the vacuum tube No field excitation is necessary. Price, $22.50



RADIO BROADCAST
June 1923

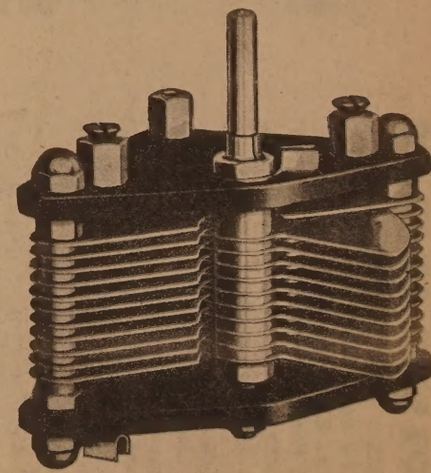
THE PATHÉ LOUD SPEAKER

Employs a parchment cone actuated by the telephone unit. The best setting of the tension on the diaphragm is obtained by screw and lock nut. This loud speaker operates directly from the second stage of an audio amplifier. Price, $24 for nickel finish, $22 for Japan Green finish



PARAGON TUNED R. F. AMPLIFIER

...ily for use with Paragon receivers. ... meters ...is unit, ...o recep- ...o



THE NEW PACENT VARIABLE CONDENSER

The plates are punched in a manner which makes washer separators unnecessary. This condenser is made in various sizes. Pacent Electric Co. Price, $3.00 to $4.75

Mr. Lee A. Davis
Route 3, Box 2203
Sumner, Wash. 98390

7